

What They Threw Overboard

The Field, the Vortex, and the Cost of Forgetting

Paul Gene Conlan

Founder, Zuzeproject LLC

Copyright © 2026 Paul Gene Conlan

All rights reserved.

No part of this publication may be reproduced, distributed, or transmitted in any form or by any means, including photocopying, recording, or other electronic or mechanical methods, without the prior written permission of the author, except in the case of brief quotations embodied in critical reviews and certain other noncommercial uses permitted by copyright law.

Published by Zuzeproject LLC.

First Edition.

ISBN: [Assign via KDP at publication]

Contents

Prologue

André-Marie Ampère and the Discovery of Electromagnetic Rotation

Michael Faraday and the Harnessing of Rotating Induction

James Clerk Maxwell and the Mechanical Unification of Fields

Albert Einstein and the Weapon Built From the Field

Oliver Heaviside and the Simplification of Electromagnetism

Nikola Tesla and the Attempt to Harness the Infinite Field

Viktor Schauberger and the Vortex Made Visible in Water

Eric Laithwaite and the Vortex Made Practical in Motion

Eric Lerner and the Plasma Universe

Closing

Author's Note

Prologue

All the stories we've been told about how reality works — whether framed as religious doctrine or scientific fact — were written by humans. Not discovered. Written. Authored by people with agendas, fears, and the power to decide what counts as permissible thought.

For centuries, church and state were joined at the hip. They didn't just teach different things — they enforced a single system of control through the same mechanism: deciding which questions you were allowed to ask. When Giordano Bruno insisted the universe was infinite, when Antoine Lavoisier pursued chemistry independent of state doctrine, when others dared to observe and think for themselves, the cost was clear. Not because their ideas were wrong, but because independent inquiry itself threatened the apparatus.

That apparatus didn't disappear. It evolved into something more sophisticated. The gatekeeping that once burned heretics now operates through institutional credential, funding control, media narratives, and the architecture of what gets published and what stays buried. It serves a system built on scarcity, artificial limitation, and manufactured conflict — one that keeps people dependent on institutions that claim to hold all the answers. The military-industrial complex didn't emerge despite this system; it emerged because of it. Conflict creates demand. Demand justifies control. Control prevents alternatives from being seen or funded.

But something else happened across those centuries. The same insight kept resurfacing. Different names, different eras, same geometric truth at the core. Vortex. Resonance. Structure. The pattern nobody was supposed to see.

This book is about what was lost — and what becomes possible when we look at it again.

The History We Were Told Wrong

The Vortex, the Field, and the Forgotten Flower

André-Marie Ampère and the Discovery of Electromagnetic Rotation

In April of 1820, Danish physicist Hans Christian Ørsted conducted an experiment during a lecture that would redirect the course of physics. He positioned a compass needle near a wire carrying electrical current from a voltaic pile—a battery of copper and zinc discs producing roughly 15 to 20 volts. The needle deflected. When he reversed the current, it deflected in the opposite direction. The effect could not be shielded by wood or glass. The magnetic influence, invisible yet real, extended outward from the wire itself.

What Ørsted observed was that the magnetic field formed in circles around the wire. The lines of force rotated. This discovery—that electric current generates a rotating magnetic field—spread rapidly through the scientific community. Within weeks, it reached Paris.

Within a week of learning of Ørsted's work, French mathematician and physicist André-Marie Ampère, then 45 years old, began a systematic investigation. Ampère was already accomplished in mathematics and chemistry, but this discovery redirected his entire focus. He would spend the next six years conducting hundreds of experiments, refining observations on the interactions between currents, magnets, and wires.

Ampère's method was direct. He built apparatus to measure forces between current-carrying wires. One of his key experiments consisted of two parallel vertical wires, each carrying current, suspended so they could move freely. When currents flowed in the same direction through both wires, they attracted each other. When currents flowed in opposite directions, they repelled. He varied the distance between them, the intensity of the current, the orientation of the wires themselves. Each result he recorded with precision.

He constructed solenoids—coils of wire wound in helices and spirals—and passed current through them, observing what magnetic effects were produced. He created galvanometers to measure the flow of electricity with sensitivity. He used astatic needles, magnetized needles arranged to cancel the influence of Earth's own magnetic field, so that only the electromagnetic effect of the current would deflect them. This allowed him to isolate the phenomenon he was studying from terrestrial noise.

What Ampère discovered through these experiments was a precise mathematical relationship: the force between two current-carrying wires is proportional to the length of wire, to the intensity of current in each, and to the inverse of the distance between them. More fundamentally, he observed that the magnetic influence around a current-carrying wire forms in circular patterns—rotating vortices of magnetic force.

By September of 1820, only months into his investigation, Ampère had made his first major discovery about the nature of this interaction. By 1826, after years of systematic work, he had developed a comprehensive theory. In 1827, he published *Mémoire sur la théorie mathématique des phénomènes électro-dynamiques uniquement déduite de l'expérience*—Memoir on the Mathematical Theory of Electrodynamic Phenomena, Uniquely Deduced from Experience. This was not speculation. This was observation formalized into law.

Ampère coined the term electrodynamics to describe this new field of study. He proposed something radical for his time: that magnetism itself arises from microscopic electric currents within materials. If current creates a rotating magnetic field around a wire, then perhaps all magnetism—even that of permanent magnets—originates from circular currents at the atomic or molecular level. He called these hypothetical circulating currents “electrodynamic molecules,” forerunners of what would later be understood as electrons.

Maxwell, decades later, would call Ampère “the Newton of electricity.”

What Ampère had done was look at the vortex that Ørsted had observed rotating around a wire, and he had measured it. He had built apparatus to quantify it. He had shown through reproducible experiment that two current-carrying conductors experience forces that depend on the direction and magnitude of their currents. He had demonstrated that the interaction is not instantaneous action at a distance, but involves a field—something real, something rotating, something that extends through space.

The flower was there. Ampère saw it.

Notes

1. Hans Christian Ørsted, “Experiments on the Effect of a Current of Electricity on the Magnetic Needle” (1820), translated in R.A.R. Tricker, *The Contributions of Faraday and Maxwell to*

- Electrical Science (Oxford: Pergamon Press, 1966).
2. Ibid.
 3. André-Marie Ampère, *Recueil d'observations électro-dynamiques* (Paris, 1822); see also James R. Hofmann, *André-Marie Ampère: Enlightenment and Electrodynamics* (Cambridge: Cambridge University Press, 1996).
 4. Hofmann, *ibid.*; Ampère documented this intensive period in his laboratory notebooks and published treatises.
 5. André-Marie Ampère, *Mémoire sur la théorie mathématique des phénomènes électro-dynamiques uniquement déduite de l'expérience* (Paris: Bachelier, 1827).
 6. Ibid.
 7. Ampère's use of astatic needles is documented in his experimental descriptions; see Linda Hall Library's biography of André-Marie Ampère, *The Founder of Electromagnetism*.
 8. This relationship is now known as Ampère's Law or Ampère's Circuital Law. See *Philosophical Transactions of the Royal Society A* 373 (2015): 20140473.
 9. Ørsted's original observation and Ampère's extensions are documented in *IEEE Spectrum*, "The Pioneer Behind Electromagnetism."
 10. Ampère, *Mémoire sur la théorie mathématique...*, *op. cit.*
 11. Ibid.
 12. Hofmann, *André-Marie Ampère*, *op. cit.*
 13. Ibid.
 14. James Clerk Maxwell, *A Treatise on Electricity and Magnetism* (Oxford: Clarendon Press, 1873), vol. 2.

Bibliography

- Ampère, André-Marie. *Recueil d'observations électro-dynamiques*. Paris, 1822.
- . *Mémoire sur la théorie mathématique des phénomènes électro-dynamiques uniquement déduite de l'expérience*. Paris: Bachelier, 1827.
- Hofmann, James R. *André-Marie Ampère: Enlightenment and Electrodynamics*. Cambridge: Cambridge University Press, 1996.
- Maxwell, James Clerk. *A Treatise on Electricity and Magnetism*. Oxford: Clarendon Press, 1873.
- Ørsted, Hans Christian. "Experiments on the Effect of a Current of Electricity on the Magnetic Needle." 1820. Translated in R.A.R. Tricker, *The Contributions of Faraday and Maxwell to Electrical Science*. Oxford: Pergamon Press, 1966.
- Tricker, R.A.R. *The Contributions of Faraday and Maxwell to Electrical Science*. Oxford: Pergamon Press, 1966.

Michael Faraday and the Harnessing of Rotating Induction

Michael Faraday was born in 1791 in Surrey, England, the son of a blacksmith. He received minimal formal education, apprenticing as a bookbinder at fourteen. Yet he read voraciously—among the books he bound, volumes on chemistry and electricity captured his imagination. By his early twenties, having attended lectures at the Royal Institution in London, he had attracted the attention of chemist Humphry Davy and joined the Institution as an assistant in 1813. For the next decade, Faraday worked under Davy in chemistry and experimental physics, developing the meticulous hands-on experimental methods that would become his hallmark.

In 1821, just as Ampère was formalizing his mathematical law of electromagnetic force, Faraday conducted an experiment that revealed something equally profound: not the force between wires, but the rotational motion generated by that force. On 3 September 1821, he arranged a wire carrying electric current to hang suspended in mercury near a magnet. When current flowed through the wire, the wire began to rotate around the magnet in circles. He sketched in his notebook the direction of rotation—clockwise around one pole, reversed around the other—and wrote simply: “Very satisfactory.”

What Faraday had constructed was the world's first electric motor. But more importantly, he had demonstrated something fundamental: that the circular magnetic force Ampère had measured now expressed itself as continuous motion. The rotating field was not merely a theoretical construct—it produced tangible, measurable action.

Faraday refined his apparatus. He constructed what became known as the homopolar motor: a magnet placed vertically in a container of mercury, with a wire suspended through it from above. When current flowed, the wire rotated. The magnetic field around the current-carrying wire—that invisible rotating vortex Ampère had measured—interacted with the field of the magnet itself, producing continuous circular motion.

For the next decade, Faraday built on this insight, asking a new question: if an electric current could produce a rotating magnetic field that moved matter, could a rotating magnetic field produce an electric current? In 1831, he began a series of

experiments that would answer that question with extraordinary clarity.

Arago's paradox had troubled the scientific community. In 1824, French physicist François Arago had demonstrated that a spinning copper disc caused a magnetic needle suspended above it to rotate, even though copper is not magnetic and no external current was applied. The effect was remarkable and unexplained. Faraday set out to understand it.

His approach was direct. He took a copper disc and rotated it by hand between the poles of a powerful horseshoe magnet. He attached two wires to the disc—one at the center, one at the outer edge—and connected them through a galvanometer, an instrument sensitive enough to detect even tiny electrical currents. When he rotated the disc, the galvanometer deflected. A steady current flowed.

This was not a transient pulse, like the brief deflection Ampère had observed when closing a circuit. This was continuous current generated by the simple act of rotating a conductor through a magnetic field. Faraday had created the world's first dynamo, the ancestor of modern electric generators.

What he had done was invert the motor. In the motor, electrical current produced rotating motion. In the generator, rotating motion produced electrical current. In both cases, the mechanism was the same: the interaction between the rotating magnetic field and the motion of a conductor.

Faraday's analysis of this phenomenon led him to formulate what became known as Faraday's Law of Electromagnetic Induction: an induced electric current in a conductor is proportional to the rate at which the magnetic field through the conductor changes. But Faraday expressed it in language of his own: the lines of magnetic force must be “cut” by a moving conductor to induce a current. The faster the lines are cut, the greater the current.

In expressing it this way, Faraday was making a philosophical claim about the nature of reality. He conceived of magnetic field lines not as abstract mathematical conveniences, but as physically real. They existed. They could be “cut.” A conductor moving through them was physically severing them, and this severance produced an electromotive force.

Faraday wrote that he had become convinced the phenomena of induction depended on the physical properties of the lines of force, not on mere formal theory. By the late 1830s, this conviction had hardened. The lines of force were not

metaphors. They were the reality itself.

In his experimental work, Faraday demonstrated this in various configurations. He wrapped two coils of wire around opposite sides of an iron ring—a primitive transformer. When he connected one coil to a battery, he observed a brief deflection in a galvanometer attached to the second coil. Only when current changed did induction occur. A steady current produced no induction. Only change in the magnetic field could produce an induced current. But Faraday understood that any time a conductor moved through that field, or the field changed through a stationary conductor, the same principle applied: the lines of force were being cut, and current would flow.

He conducted hundreds of variations on this theme, each one refining his understanding. Iron rings, copper discs, coils wrapped around magnets, magnets thrust in and out of coils, wires rotated in fields, fields rotated around wires—the principle was always the same.

What Faraday had shown was that the rotating magnetic field, which Ampère had measured as a force, could be harnessed. It could do work. It could generate continuous electrical current. The flower was not just present—it was productive.

By the 1830s, Faraday began developing a more sophisticated conception of what was actually happening in these experiments. He introduced the concept of the “electrotonic state”—a condition of the medium surrounding a magnet or current-carrying wire in which that medium held a peculiar electrical character. When this state changed—when a conductor moved through it, or when a magnetic field shifted—an electromotive force appeared. The current that flowed was a consequence of the change in this state.

This was radical thinking. Faraday was proposing that space itself—the medium between objects—was not empty. It possessed properties. It could be in different states. Electricity and magnetism were not forces acting instantaneously at a distance, as Newton's tradition held. They were properties of a medium, a field that permeated all space.

In his *Experimental Researches in Electricity*, published between 1831 and 1855, Faraday documented thousands of observations, each one building on the last. He used iron filings to visualize the pattern of magnetic lines of force around magnets and current-carrying wires—the familiar patterns still shown in textbooks today, the

concentric circles, the loops and curves that trace the shape of the invisible field. By arranging these filings on paper placed over magnets, he could see the geometry of the force.

What struck him was the elegance of these patterns. The lines were not random. They formed organized structures. They curved and spiraled. Around a current-carrying wire, they formed circles—vortices of force. Around a magnet, they formed loops that connected pole to pole. These patterns suggested an underlying order, a geometry to the invisible.

Faraday's framework was qualitative where Ampère's had been quantitative. Ampère had measured forces and derived mathematical laws. Faraday observed patterns and drew conclusions about the nature of the medium itself. Yet both men were describing the same phenomenon: a rotating, structured field of force surrounding every current and magnet.

By the time Faraday published his final researches in 1855, he was an elderly man, his health declining. Yet his body of experimental work stood as testimony to a lifetime of careful observation. He had shown that electricity and magnetism were not isolated phenomena—they were intimately connected, each generating the other, both expressing the properties of a rotating field that permeated space.

The flower was blooming. Maxwell, a young mathematician reading Faraday's work in Scotland, would soon take up the task of formalizing what Faraday had observed.

Notes

1. Faraday, Michael. *Experimental Researches in Electricity*. London: Royal Institution, 1831–1855.
2. Pearce Williams, L. *Michael Faraday: A Biography*. New York: Basic Books, 1965.
3. Royal Institution records; IEEE Spectrum, “200 Years Ago, Faraday Invented the Electric Motor” (2021).
4. *Ibid.*; Faraday's notebook entries from September 3, 1821, Royal Institution Archives.
5. American Physical Society, “September 4, 1821 and August 29, 1831: Faraday and Electromagnetism” (2001).
6. SPARK Museum of Electrical Invention, “Faraday's Rotating Cup Experiment.”
7. Faraday, *Experimental Researches in Electricity*, op. cit.
8. François Arago, “On the Magnetism Manifested by Rotation,” *Annales de Chimie et de Physique*, 1824.

9. Computer History Museum, “1831: Faraday Describes Electro-Magnetic Induction.”
10. Ibid.
11. IEEE Spectrum, op. cit.
12. Faraday, *Experimental Researches in Electricity*, op. cit.
13. Michael Faraday, *Thoughts on Ray Vibrations* (1846).
- 14–20. Faraday, *Experimental Researches in Electricity*, multiple volumes, op. cit.

Bibliography

- American Physical Society. “September 4, 1821 and August 29, 1831: Faraday and Electromagnetism.” *APS News* (2001).
- Arago, François. “On the Magnetism Manifested by Rotation.” *Annales de Chimie et de Physique* (1824).
- Computer History Museum. “1831: Faraday Describes Electro-Magnetic Induction.”
- Faraday, Michael. *Experimental Researches in Electricity*. London: Royal Institution, 1831–1855.
- . *Thoughts on Ray Vibrations*. 1846.
- IEEE Spectrum. “200 Years Ago, Faraday Invented the Electric Motor.” 2021.
- Pearce Williams, L. *Michael Faraday: A Biography*. New York: Basic Books, 1965.
- SPARK Museum of Electrical Invention. “Faraday’s Rotating Cup Experiment.”

James Clerk Maxwell and the Mechanical Unification of Fields

James Clerk Maxwell was born on 13 June 1831 in Edinburgh, Scotland, into a family of modest wealth and significant intellectual standing. His father was a lawyer; his mother, Frances Cay, came from a family of Scottish landed gentry. Shortly after his birth, the family moved to Glenlair, their country estate in Kirkcudbrightshire, where young Maxwell grew up in rural surroundings that nurtured his natural curiosity.

As a child, Maxwell displayed an insatiable interest in how things worked. A family letter from 1834, when he was barely three years old, described him as fascinated by “doors, locks, keys” and constantly asking “Show me how it doos.” He traced the hidden paths of streams, followed bell-wires through walls, investigated how water moved from pond to drain. This was not idle play—it was the work of a mind seeking to understand the mechanics of the invisible.

After his mother's death in 1839, Maxwell was sent to the Edinburgh Academy at age ten, where he received formal education in mathematics, classics, and natural philosophy. By age fourteen, he had published his first scientific paper, "On the Description of Oval Curves," demonstrating a precocious gift for mathematical insight. He went on to study at the University of Edinburgh and then Trinity College, Cambridge, where he earned distinction in mathematics and won the Smith's Prize in 1854.

What set Maxwell apart was his approach to learning. Before beginning his study of electricity and magnetism in earnest, he made a deliberate choice: he resolved to read no mathematical treatises on the subject until he had first read through Michael Faraday's *Experimental Researches in Electricity*—all three volumes, which documented Faraday's life work from 1831 onward. This was unusual. Most physicists of his era approached Faraday's work with skepticism. Faraday was an experimentalist, not a mathematician. His language was qualitative, his diagrams of "lines of force" seemed to many like mere metaphors. Yet Maxwell saw something others did not: he saw that Faraday had grasped something fundamental about the nature of electromagnetic phenomena, and that the mathematical framework needed to express it was waiting to be built.

In 1855 and 1856, Maxwell presented a paper to the Cambridge Philosophical Society titled "On Faraday's Lines of Force." In it, he did something remarkable: he took Faraday's purely experimental observations and demonstrated that they could be understood through mathematical analogy. By imagining the lines of force as actual physical entities—not mere representations but real structures in space—Maxwell showed that Faraday's qualitative insights could be rendered in rigorous mathematical form.

But this was only the beginning. Maxwell's ambition extended further. He did not merely want to mathematize Faraday's observations; he wanted to understand the physical mechanism underlying them. What was creating these lines of force? What was the nature of the medium through which they acted?

Between 1861 and 1862, Maxwell published a four-part paper titled "On Physical Lines of Force." In it, he went beyond mathematics into physical theory. He proposed that space was not empty. Instead, it was filled with a medium—an invisible substance he called an "aether"—composed of countless tiny rotating structures he termed "molecular vortices."

Maxwell's model was mechanical and explicit. Imagine space filled with infinitesimal spinning cells, like tiny whirlpools or vortices. These vortices rotate in a direction determined by the magnetic field. Between the vortices sit smaller particles—"idle wheels"—that transmit the rotation from one vortex to the next. When current flows through a wire, it sets these vortices into motion in a coordinated pattern. The result is a rotating field that extends outward in circles around the wire—precisely the vortex that Ampère had measured and Faraday had observed.

More than this: Maxwell showed that in this mechanical model, the rotation of the vortices produces stresses and pressures in the medium. These stresses manifest as electric and magnetic forces. A changing magnetic field—vortices accelerating or decelerating—creates an electric field. A time-varying electric field creates a magnetic field. Each generates the other in a perpetual dance.

From this mechanical model, Maxwell derived a comprehensive set of equations describing electromagnetic phenomena. Twenty equations in their original form, each one emerging naturally from the geometry and dynamics of the vortex system. These equations unified what had previously been understood as separate domains: electricity, magnetism, and the behavior of conductors and insulators all flowed from a single coherent mechanical picture.

Maxwell went further still. Using the results of electromagnetic experiments performed by Wilhelm Weber and Rudolf Kohlrausch—measurements of how fast electrical disturbances propagate—he calculated the speed at which waves would travel through his hypothetical vortex-filled aether. The calculation yielded a number almost exactly equal to the speed of light, measured directly by Hippolyte Fizeau.

Maxwell then wrote words that would echo through physics for the next century: that he could scarcely avoid the inference that light consists in the transverse undulations of the same medium which is the cause of electric and magnetic phenomena.

In other words: light and electromagnetism were expressions of the same phenomenon—the oscillations of the rotating vortex field that pervades all space. Electricity, magnetism, and light were unified. They were all manifestations of a single underlying mechanism: the rotating vortex structure of the medium itself.

In 1865, Maxwell published a refined version of this theory under the title "A Dynamical Theory of the Electromagnetic Field." Here he moved from mechanical

analogy toward a more abstract formulation, yet the physics remained the same—derived from the vortex model, expressed in the language of moving fields and stresses in a medium.

Maxwell then undertook the monumental task of systematizing his work into a comprehensive textbook: *A Treatise on Electricity and Magnetism*, published in 1873. It was a sprawling work, dense with mathematics and physical reasoning, difficult for contemporaries to grasp fully. Yet it stood as a complete mathematical and physical framework for understanding electromagnetism—all derived, ultimately, from Faraday's concept of lines of force and Maxwell's mechanical model of rotating vortices.

Maxwell did not live to see his theory vindicated experimentally. He died of abdominal cancer on 5 November 1879, at age 48—the same age at which his mother had died of the same disease. When he passed, his electromagnetic theory remained controversial. Many physicists still viewed it as incomplete or overly speculative. The idea that space was filled with an invisible rotating medium seemed fantastic.

It took another eight years—1887—for German physicist Heinrich Hertz to produce the first man-made electromagnetic waves, confirming Maxwell's prediction that electromagnetic disturbances propagate as waves through space. But Maxwell was already gone.

What Maxwell had accomplished was extraordinary: he had taken Faraday's intuitive grasp of field phenomena and given it mathematical rigor and physical meaning. He had proposed that beneath all of electromagnetic reality lay a unified mechanism—the rotating vortex structure of the aether itself. Electricity, magnetism, light, and the forces that move charged particles—all were expressions of this single underlying geometry.

The flower was fully bloomed. Yet what came next would shrivel it.

Notes

1. MacTutor History of Mathematics Archive, James Clerk Maxwell (1831–1879).
2. Britannica, “James Clerk Maxwell”; Clerk Maxwell Foundation.
3. MacTutor, op. cit.; letter dated 25 April 1834.

4. National Library of Scotland, James Clerk Maxwell Biography.
5. Famous Scientists, “James Clerk Maxwell.”
6. Wikipedia, “James Clerk Maxwell”; Maxwell (1954), *Scientific Papers*, Cambridge University Press.
7. PMC/NIH, “‘...a paper ...I hold to be great guns’: a commentary on Maxwell (1865).”
8. Maxwell, J.C. “On Faraday’s Lines of Force.” *Cambridge Philosophical Society*, December 1855 and February 1856.
9. *In Compliance Magazine*, “Faraday’s Lines of Force and Maxwell’s Theory of the Electromagnetic Field.”
10. Maxwell, J.C. “On Physical Lines of Force.” *Philosophical Magazine*, Series 4, vol. 21, 1861. 11–13. *Ibid*.
14. *History of Maxwell’s Equations*, Wikipedia.
- 16–18. Maxwell, “On Physical Lines of Force,” *op. cit*.
19. Maxwell, J.C. “A Dynamical Theory of the Electromagnetic Field.” *Philosophical Transactions of the Royal Society*, 1865.
21. Maxwell, J.C. *A Treatise on Electricity and Magnetism*. Oxford: Clarendon Press, 1873.
- 22–23. *Britannica*, *op. cit*.; *IEEE Spectrum*, “The Long Road to Maxwell’s Equations.”

Bibliography

- Britannica*. “James Clerk Maxwell.”
- Clerk Maxwell Foundation. “Who was James Clerk Maxwell?”
- IEEE Spectrum*. “The Long Road to Maxwell’s Equations.”
- In Compliance Magazine*. “Faraday’s Lines of Force and Maxwell’s Theory of the Electromagnetic Field.”
- MacTutor History of Mathematics Archive. “James Clerk Maxwell (1831–1879).”
- Maxwell, J.C. “A Dynamical Theory of the Electromagnetic Field.” *Philosophical Transactions of the Royal Society*, 1865.
- . “On Faraday’s Lines of Force.” *Cambridge Philosophical Society* (1855–1856).
- . “On Physical Lines of Force.” *Philosophical Magazine*, Series 4, vol. 21 (1861).
- . *A Treatise on Electricity and Magnetism*. Oxford: Clarendon Press, 1873.
- National Library of Scotland. James Clerk Maxwell Biography.

Albert Einstein and the Weapon Built From the Field

Albert Einstein was born on 14 March 1879 in Ulm, in the German Empire—coincidentally the same year that Maxwell died. He showed an early fascination with the invisible structuring of the physical world; family accounts describe a five-year-old Einstein transfixed by a pocket compass his father showed him, astonished that an unseen force could move the needle regardless of how the compass was turned. He studied at the Federal Polytechnic in Zurich, graduating in 1900, then found work in 1902 as a patent examiner, third class, at the Swiss Federal Institute of Intellectual Property in Bern—evaluating inventions for their technical soundness while pursuing physics on his own time.

In 1905, working from that patent office, Einstein published four papers that would each, individually, have secured him a significant place in the history of physics. The third of these, titled “On the Electrodynamics of Moving Bodies,” addressed a problem that traced directly back to Faraday: in the conventional theory, a moving magnet near a stationary coil and a moving coil near a stationary magnet produced the same induced current, yet the standard electromagnetic theory of the day explained the two cases with entirely different physical mechanisms, depending on which object was considered to be “really” moving. Einstein found this asymmetry troubling. He resolved it by proposing that no privileged frame of rest exists in the universe—that the laws of electrodynamics, including the constancy of the speed of light that fell directly out of Maxwell's equations, must hold identically in every frame of reference moving at constant velocity. This was special relativity. It was not, in its origin, a theory about space stations or twin paradoxes. It was a direct attempt to make Maxwell's electromagnetic field theory fully self-consistent.

The same body of 1905 work yielded the equation that would become the most recognized in physics: $E = mc^2$, the statement that mass and energy are equivalent, interchangeable expressions of the same underlying quantity. A decade later, in 1915, Einstein extended this framework into general relativity, describing gravity not as a force acting across empty space but as the curvature of spacetime itself in response to mass and energy—a geometric account of gravitation that subsumed and extended Newton's, much as Maxwell's field theory had subsumed and extended the separate domains of electricity and magnetism. Einstein received the Nobel Prize in Physics in 1921, formally awarded for his explanation of the photoelectric effect rather than for relativity, which remained, even then, a subject of ongoing debate within parts of the physics community.

Einstein was a committed pacifist for the whole of his adult life, publicly affiliated with peace and disarmament movements throughout the 1920s and into the 1930s. When the Nazi party rose to power in Germany, Einstein, who was Jewish, emigrated to the United States in 1933, taking a position at the Institute for Advanced Study in Princeton.

In the summer of 1939, physicists Leo Szilard and Eugene Wigner visited Einstein at his summer residence on Long Island. They had grown alarmed: German scientists Otto Hahn and Fritz Strassmann had recently discovered nuclear fission, and the physics required to turn that discovery into an extraordinarily powerful weapon was, in principle, now understood. Szilard and Wigner feared that Nazi Germany might pursue such a weapon first. Einstein, who had not previously considered the chain-reaction implications of fission, was reportedly startled by what Szilard described to him. He agreed to lend his name and reputation to a letter, drafted primarily by Szilard, addressed to President Franklin Roosevelt, warning of the danger and urging American research into the possibility. Einstein signed the letter on 2 August 1939. It is widely credited as the catalyst that led Roosevelt to establish the advisory committee that eventually grew into the Manhattan Project.

Einstein himself never worked on the Manhattan Project. In 1940, he was denied the security clearance that participation would have required, owing to his long public record of pacifist and left-leaning political activity, which U.S. military intelligence considered a security risk. He had no role in the project's scientific work, no knowledge of its operational details, and no advance knowledge of the decision to use the resulting weapons against Hiroshima and Nagasaki in August 1945—a decision made roughly a month after the device was first tested at the Trinity site in the New Mexico desert on 16 July 1945.

Einstein came to regard his involvement with profound regret. In remarks later reported in *Newsweek*, he said that had he known Germany would not succeed in building such a weapon, he would never have lifted a finger. In a letter to the chemist Linus Pauling, he went further, describing the decision to sign the 1939 letter as the single greatest mistake of his life. He spent much of his remaining career, alongside continued work in physics, as a public advocate for nuclear disarmament and international control of atomic weapons.

Einstein died on 18 April 1955, in Princeton, New Jersey, at age seventy-six.

What had happened, traced through the chain this chapter has followed, was this: Maxwell had unified electricity, magnetism, and light into a single field theory built on a mechanical model of rotating vortices. Einstein, picking up the asymmetries left unresolved in that same field theory, unified space, time, mass, and energy into a single relativistic framework—extending the same impulse toward unification one step further, into the geometry of the universe itself. The theoretical insight that mass and energy were equivalent, born from working out a contradiction in how Maxwell's equations described a magnet and a coil, became—through a chain of events Einstein set in motion but did not control and ultimately disowned—the theoretical foundation beneath a weapon that erased two cities in a single morning each.

The mechanism Maxwell described, that Heaviside trimmed for telegraph wires, that Tesla tried to broadcast freely, found its largest expression not as abundance, but as Trinity.

Notes

1. Britannica, “Albert Einstein”; born 14 March 1879, Ulm, German Empire.
2. Pais, Abraham. *Subtle is the Lord: The Science and the Life of Albert Einstein*. Oxford: Oxford University Press, 1982.
- 3–4. History.com, “Albert Einstein”; patent office position, Bern, 1902–1909; four papers published 1905.
- 5–7. SparkNotes, “Albert Einstein Study Guide: Special Relativity”; Encyclopedia.com, “Einstein: Theory of Relativity.”
- 8–10. History.com, *op. cit.*; Britannica, *op. cit.*; Nobel Prize 1921 for the photoelectric effect.
- 11–12. Britannica, *op. cit.*; emigration to the United States, 1933.
- 13–17. Atomic Heritage Foundation, “The Einstein-Szilard Letter – 1939”; Biography.com, *op. cit.*; Bulletin of the Atomic Scientists, *op. cit.*
- 18–19. Atomic Heritage Foundation, *op. cit.*; Trinity test, 16 July 1945.
- 20–21. Time, “The Lesson of Einstein's Warning to FDR on Nuclear Weapons”; Ynetnews, *op. cit.*; letter to Linus Pauling.
- 22–23. Britannica, *op. cit.*; died 18 April 1955, Princeton, New Jersey.

Bibliography

Atomic Heritage Foundation. “The Einstein-Szilard Letter – 1939.”
Biography.com. “Albert Einstein Regretted His Role in the Atomic Bomb's Creation.”

Britannica. "Albert Einstein."

Bulletin of the Atomic Scientists. "Albert Einstein, Leó Szilárd and the letter that led to Manhattan Project."

Encyclopedia.com. "Einstein: Theory of Relativity."

History.com. "Albert Einstein."

Pais, Abraham. *Subtle is the Lord: The Science and the Life of Albert Einstein*. Oxford: Oxford University Press, 1982.

SparkNotes. "Albert Einstein Study Guide: Special Relativity."

Time. "The Lesson of Einstein's Warning to FDR on Nuclear Weapons."

Ynetnews. "Einstein's 1939 letter to Roosevelt warning of Nazi nuclear efforts sells for \$3.9 million."

Oliver Heaviside and the Simplification of Electromagnetism

Oliver Heaviside was born on 18 May 1850 in Camden Town, London—a crowded, working-class neighborhood far removed from the genteel academic circles where science was typically made. His father, Thomas Heaviside, was an engraver of modest means. His mother was Rachel West, sister to Sir Charles Wheatstone, the inventor of the telegraph—a connection that would subtly shape young Oliver's future.

Heaviside's early years were marked by hardship and isolation. At around age nine, he contracted scarlet fever, an illness that left him profoundly deaf—nearly completely so, persisting for the rest of his life. In an era when hearing loss meant social exclusion, the condition drove him inward. He left school at sixteen without formal higher education, his prospects limited by poverty and disability.

Yet he possessed an extraordinary mind. Through his uncle's connections, he found work as a telegraph operator, first in Denmark in 1868, then with the Great Northern Telegraph Company in Newcastle upon Tyne beginning in 1871. As a young telegraph engineer, he was exposed to the practical problems of electrical transmission. How could signals be sent reliably over long distances? How could distortion be minimized? How could speed be maximized? These were not abstract questions—they were problems that limited commerce, communication, and the growing technological ambitions of industrial society.

In 1872 and 1873, while still working in Newcastle, Heaviside published papers on electric circuits and telegraphy. His work was solid and pragmatic—focused on making telegraph systems work better. But something shifted when he encountered Maxwell's *Treatise on Electricity and Magnetism*, which had been published in 1873. Heaviside became fascinated. Here was a complete mathematical and physical framework for understanding electromagnetic phenomena. Here was Maxwell's vortex model, his twenty equations, his mechanical picture of a rotating aether.

In 1874, at age twenty-four, Heaviside made a decision that would alter the trajectory of physics. He quit his job at the telegraph company and returned to his parents' house in London. He had no other employment prospects, no university position, no financial security. His brother Arthur provided some financial support, but Heaviside worked in near-complete isolation—in a spare room of his parents' home, growing progressively more deaf and reclusive, rarely leaving the house, never marrying.

For the next decade or more, working alone in that room, Heaviside undertook the monumental task of mastering Maxwell's theory. He taught himself advanced mathematics. He absorbed the intricacies of Maxwell's vortex-based derivation. And then, having understood it, he began to ask a practical question: could this be simplified? Could the mathematics be made more elegant, more usable, more suitable for engineers working on real telegraph and electrical distribution problems?

The answer, for Heaviside, was yes. Beginning around 1880, he developed what he called “duplex notation”—a reformulation of Maxwell's equations using vector calculus. Vector calculus was a new mathematical tool, still being developed in Heaviside's own time. By expressing Maxwell's twenty equations in this new language, Heaviside showed that twelve of them could be combined or eliminated, leaving four core equations describing the behavior of electric and magnetic fields.

But there was a cost to this simplification. Maxwell's original equations had included the vector and scalar potentials—mathematical quantities that represented, in Maxwell's conception, the electromagnetic momentum and the structure of the medium itself. The potentials were how Maxwell connected his abstract mathematics back to the physical model: the rotating vortices of the aether.

Heaviside eliminated them. He removed the potentials from the equations, keeping only the electric field E , the magnetic field B , the displacement field D , and the magnetic field H . The resulting four equations were elegant, symmetrical, and

beautiful—a mathematician's dream. But they were also stripped of the mechanical underpinning that Maxwell had labored to provide.

Years later, Heaviside would reflect on this choice. In a letter to the physicist FitzGerald, he wrote a line that would become famous: “I never made any progress until I threw all the potentials overboard.” One historian later described the potentials as having been “gleefully murdered.” For Heaviside, the removal of these theoretical abstractions opened the way to see clearly the symmetries in the equations, to express them in the elegant language of vector calculus, and to make them tools that engineers could actually use.

And they could. Heaviside's simplified equations worked. They could predict how electromagnetic waves would propagate. They could explain how telegraph signals traveled down wires. They could be applied to practical problems of electrical engineering. The trade—removing the mechanical picture of the aether in exchange for mathematical clarity and engineering utility—seemed eminently reasonable.

Heaviside did not see himself as destroying Maxwell's vision. He saw himself as clarifying it, distilling it, presenting it in a form that the world could actually use. He developed operational calculus for solving differential equations. He predicted the existence of the ionosphere. He invented tools that enabled the development of radio and electrical power transmission. His contributions were real and profound.

Yet what happened next was not his decision to make. The world took Heaviside's four equations and ran. Textbooks were written using only those four equations. Universities began teaching only the field formulation, not the mechanical vortex model. The concept of the electromagnetic momentum faded from sight. The idea that space was filled with a rotating medium—that the fields themselves were expressions of something mechanically real—became increasingly abstract, then forgotten.

No one after Heaviside looked back to ask: what did we lose when we removed the potentials? What did Maxwell understand about the mechanical basis of electromagnetism that we no longer teach? What flower did we trade for this stick?

These were not questions Heaviside posed. He had solved the problem he set out to solve: making Maxwell's theory usable for engineers. That the broader understanding was narrowed in the process—that the mechanical picture was

discarded—that was not his concern. It was ours.

We made that choice. All of us. The scientific establishment, the engineering community, the textbook writers, the universities, the culture of accepting what works without asking what was left behind. We chose the tool. We chose the utility. We chose to move forward without looking back.

Heaviside died on 3 February 1925, in Torquay, Devon, at the age of seventy-four, largely forgotten and marginalized in his later years, despite the revolutionary nature of his contributions. He never received the recognition he deserved. Yet his equations remain—four elegant statements of mathematical law, stripped of their mechanical foundation, still taught in every physics university in the world.

Notes

1. Oliver Heaviside, Wikipedia; IET Archives, “Oliver Heaviside 1850–1925.”
2. IET Archives, op. cit.; Britannica, “Oliver Heaviside.”
3. Physics Today, “Oliver Heaviside: A first-rate oddity.”
4. MacTutor History of Mathematics, “Oliver Heaviside (1850–1925).”
- 5–6. Ibid.; EBSCO Research, “Oliver Heaviside.”
7. Physics Today, op. cit.
- 8–9. MacTutor, op. cit.; Physics Today, op. cit.
- 10–11. IEEE Spectrum, “The Long Road to Maxwell's Equations”; ETHW, “Maxwell's Equations.”
- 12–13. History of Maxwell's Equations, Wikipedia.
14. River Publishers, “Twenty Three Years: The Acceptance of Maxwell's Equations”—Heaviside to FitzGerald: “I never made any progress until I threw all the potentials overboard.”
15. Ibid.—“The potentials are gleefully ‘murdered’ according to Heaviside.”
16. Britannica, “Oliver Heaviside”—predicted existence of the ionosphere.
17. Wikipedia, “Oliver Heaviside”; died 3 February 1925, age 74, in Torquay.

Bibliography

Britannica. “Oliver Heaviside.”
EBSCO Research. “Oliver Heaviside.”
Engineering and Technology History Wiki (ETHW). “Maxwell's Equations.”

IEEE Spectrum. “The Long Road to Maxwell's Equations.”

MacTutor History of Mathematics. “Oliver Heaviside (1850–1925).”

Physics Today. “Oliver Heaviside: A first-rate oddity.”

River Publishers. “Twenty Three Years: The Acceptance of Maxwell's Equations.”

“Oliver Heaviside.” Wikipedia.

Nikola Tesla and the Attempt to Harness the Infinite Field

Nikola Tesla was born on 10 July 1856 in Smiljan, a small village in the Austrian Empire (present-day Croatia), in a region of profound natural beauty and cultural complexity. His father was an Orthodox Christian priest; his mother, Djouka Mandic, was known for her exceptional memory and mechanical ingenuity—she could perform complex mathematical calculations from memory and had designed various household implements. Tesla inherited from her a mind of extraordinary power.

From earliest childhood, Tesla displayed an intensity of focus that bordered on obsession. He would become captivated by an idea and pursue it relentlessly, often to the exclusion of sleep, food, or social interaction. His childhood was marked by vivid visualizations—he would imagine machines in extraordinary detail, see them operating in his mind with perfect clarity, and later construct them in reality with minimal modification. This capacity for mental visualization would become his defining characteristic as an inventor.

Tesla received his early education in Croatia and later attended technical school in Karlovac. At age seventeen, he enrolled at the Austrian Polytechnic in Graz to study engineering. It was there, in the mid-1870s, that Tesla witnessed a demonstration that would redirect his life: a Gramme machine—an early electrical generator—was shown to produce current in both directions depending on how it was connected. The machine sparked an idea in his mind. What if, instead of using mechanical commutators to reverse the current direction, one could use alternating current itself—current that naturally reversed direction—to create a rotating magnetic field?

The problem was well-known to electrical engineers of the era: alternating current was difficult to work with. Direct current from batteries was steady, controllable, easy to distribute. But alternating current offered advantages—it could

be transformed to different voltages using transformers, making it more suitable for long-distance transmission. Yet how could one build a practical motor using alternating current when the current was constantly changing direction?

Tesla became obsessed with the problem. He left the Polytechnic without completing his degree and moved to Budapest, where he worked as a telegraph engineer. For years, he wrestled with the idea conceptually, visualizing in his mind the solution to the rotating field problem. Then, in early 1882, walking through a park in Budapest with a colleague, the solution came to him in a flash of inspiration. He could see it perfectly in his mind: multiple alternating currents, out of phase with each other, flowing through multiple coils arranged in a circle. Each current would create its own magnetic field; the phase difference between them would cause those fields to rotate in space—a perfect rotating magnetic field, exactly what Faraday and Maxwell had described.

Tesla sketched the idea in the dirt with a stick. The polyphase AC motor had been conceived.

In 1884, Tesla immigrated to the United States, arriving in New York with little more than the clothes he wore and a letter of introduction. He found work with Thomas Edison's company, but the relationship was tense. Edison was invested in direct current systems; Tesla believed alternating current was the future. Their visions for how electricity should be distributed and used were fundamentally opposed.

By 1887, Tesla had begun building prototypes of his polyphase AC motor. He applied for patents. The motor worked precisely as he had envisioned it: multiple AC currents, properly phased, created a rotating magnetic field that turned the rotor with smooth, continuous power. It was elegant, efficient, and solved the fundamental problem of AC motor design that had plagued electrical engineers for years.

Westinghouse Electric, the manufacturing company led by George Westinghouse, recognized the value of Tesla's invention. In 1888, Westinghouse purchased the rights to Tesla's polyphase system. For a time, it seemed that Tesla's vision would prevail—that alternating current, with its superior transmission capabilities and Tesla's elegant motor design, would become the standard for electrical distribution across America and the world.

And in a sense, it did. The polyphase AC system became the foundation of modern electrical power. Westinghouse's AC system, powered by Tesla's motor, prevailed in the so-called “War of Currents” against Edison's DC system. By the turn of the century, AC power was becoming dominant.

Yet something was lost in the victory. Tesla had not merely invented a better motor. He had grasped something deeper: that the rotating magnetic field itself—the vortex that Faraday had observed, that Maxwell had formalized—was the fundamental mechanism underlying electrical power generation and transmission. The motor was just one application of this principle. There were others.

In 1891, Tesla began experimenting with wireless transmission of electrical energy. His idea was radical: if electromagnetic waves could propagate through space, as Maxwell and Hertz had demonstrated, why not use those waves to transmit electrical power wirelessly? Why did every device need to be connected by wire to a central power station?

Tesla imagined a system where electrical energy could be broadcast from a central transmitter and received by appropriately tuned receivers anywhere on the globe. Power could be transmitted as freely as radio waves. The rotating electromagnetic field itself—the field that permeated all space—could be tapped into directly.

To pursue this vision, Tesla needed funding and a location to build his transmitter. In 1901, J.P. Morgan, the most powerful financier in America, agreed to fund the project. Tesla began construction of Wardenclyffe Tower on Long Island, New York—a massive structure designed to transmit electrical energy wirelessly across the Atlantic and, Tesla hoped, eventually to the world.

But by 1902, Morgan began to have second thoughts. The project was consuming vast sums of money, and the technical challenges were immense. More troubling to Morgan was the fundamental nature of what Tesla was attempting: wireless power transmission meant that power could not easily be metered in the way wired distribution could. The business model of centralized electrical generation and distribution—the model on which Morgan's other investments depended—would face an uncertain future under such a system.

In 1905, Morgan withdrew his funding. Wardenclyffe Tower, incomplete, stood unfinished and was eventually demolished. Tesla's vision of global wireless power

transmission was never realized at the scale he had imagined.

Tesla lived another thirty-one years, but his most influential public work was behind him. He continued experimenting and made various claims about further inventions, while living in increasing financial difficulty and personal isolation. He died on 7 January 1943, in a New York hotel room, at age eighty-six.

In the decades after his death, Tesla's legacy became confused and contradictory. Some hailed him as a visionary genius; others viewed his later wireless transmission claims with skepticism unsupported by mainstream physics. His polyphase AC motor was widely acknowledged as a genuine, foundational contribution to electrical engineering. His deeper claims about wireless energy transmission at a planetary scale remained, and remain, outside the scientific consensus.

Yet the documented facts remain: Tesla understood the rotating magnetic field with extraordinary depth. He understood that this field could create motion—the motor. He understood that electromagnetic waves could carry energy through space—his experiments demonstrated wireless transmission at smaller scales, even if not at the planetary scale he envisioned. He pursued, seriously and with significant financial backing, an alternative model of energy distribution to the one that ultimately prevailed.

Tesla had tried to build something different. The funding ran out before the world found out whether it could have worked.

Notes

- 1–2. Tesla biography, Wikipedia; Britannica, “Nikola Tesla.”
3. Margaret Cheney, *Tesla: Man Out of Time* (New York: Prentice Hall, 1981).
- 4–5. Wikipedia, “Nikola Tesla”; Cheney, *op. cit.*
- 6–7. Cheney, *op. cit.*
- 8–9. Wikipedia, “Nikola Tesla”; Cheney, *op. cit.*
- 10–11. Wikipedia, “Nikola Tesla”; U.S. Patent 381,968 (1888).
12. Wikipedia, “War of the Currents.”
- 13–14. Cheney and Robert Uth, *Tesla: Master of Lightning* (New York: Barnes and Noble, 1999).
- 15–16. Cheney, *Tesla: Man Out of Time*, *op. cit.*; Wikipedia, “Wardenclyffe Tower.”
- 17–18. Wikipedia, “Wardenclyffe Tower”; Morgan withdrew funding in 1905.

19–21. Cheney, op. cit.; Wikipedia, “Nikola Tesla,” died 7 January 1943.

Bibliography

Britannica. “Nikola Tesla.”

Cheney, Margaret. *Tesla: Man Out of Time*. New York: Prentice Hall, 1981.

Cheney, Margaret, and Robert Uth. *Tesla: Master of Lightning*. New York: Barnes and Noble, 1999.

Tesla, Nikola. U.S. Patent 381,968 (1888). [Polyphase motor patent.]

———. *My Inventions: The Autobiography of Nikola Tesla*. New York: Ben Johnston, 1982.

“Nikola Tesla.” Wikipedia.

“War of the Currents.” Wikipedia.

“Wardenclyffe Tower.” Wikipedia.

Viktor Schauberger and the Vortex Made Visible in Water

Viktor Schauberger was born on 30 June 1885 in Holzschlag, Upper Austria, into a family with generations of tradition as foresters and wardens of the Alpine woodlands. He attended elementary school in Aigen and grammar school in Linz, then trained formally at the forestry school in Aggsbach, qualifying as a forester in 1904. From 1904 to 1906 he worked as a forest clerk in Lower Austria. Unlike his brothers, who pursued university education, Schauberger chose the forest itself as his classroom—he later described the formal academic approach to nature as alienated from the thing it claimed to study, and committed instead to direct, sustained observation.

What Schauberger watched, for years, was water. Not water in laboratory vessels or engineering diagrams, but water moving through its natural environment—mountain streams, meandering rivers, the spiral path a trout holds against a current. He observed that water in nature rarely moves in straight lines. It curves, spirals, and forms vortices, particularly in cold, shaded, fast-moving conditions. He came to believe that this spiraling, vortical motion was not incidental to water's behavior but central to it—a structuring principle that affected water's density, its capacity to carry objects, and its vitality as a medium.

In 1920, Schauberger became head forest warden on the estate of Prince Adolf von Schaumburg-Lippe at Brunnenthal-Steyerling. The Prince faced a practical problem: timber from the remote, steep forests was expensive to transport, and the cost of conventional methods consumed most of the profit from logging. Engineers and experts had proposed various solutions; none were practical. Schauberger proposed something radical: he could reduce the transport cost from twelve schillings per cubic meter to one.

His solution, built in 1922, was a redesigned log flume. Conventional flumes used straight channels. Schauberger built his with a winding, serpentine path, incorporating counter-curves along the sides, modeled on the double-spiral motion he had observed in a swimming snake crossing a current. He kept the water cold and shaded, in conditions he believed maximized its density and vortical structure. The result was striking: logs that should have been too dense to float—winter-felled beech and other heavier-than-water timbers—moved smoothly down the flume on a layer of water barely a foot deep, spinning and twisting through the channel like the snake that had inspired the design.

The flumes worked. They reduced transport costs dramatically, and from 1924 to 1928 Schauberger served as a national consultant for timber flotation, building successful flumes across Austria, Bavaria, and Yugoslavia. In 1929, he filed his first patent applications in water engineering and turbine construction. Over the following years, he pursued increasingly ambitious applications of the same underlying principle: that vortical, spiraling motion—implosion, as he came to call it, in contrast to the explosive, linear forces underlying most contemporary engineering—could be harnessed for energy generation, water purification, agriculture, and propulsion. He designed a “trout turbine” inspired by observations of how trout held position in fast currents, and worked on devices to generate electricity directly through controlled vortex motion in water.

In 1939, Schauberger filed a patent with the Reich Patent Office for what he described as a multistage centrifuge with concentrically arranged pressure chambers—a device intended to propel machines through air or water, purify water, or generate electricity through implosion principles. He had, by this point, developed a comprehensive theory: that nature's preferred mode of generating and conducting energy was through centripetal, spiraling, cooling motion, in contrast to the centrifugal, heat-generating, explosive methods that dominated contemporary engineering and industry. Where conventional turbines and engines pushed outward

and generated heat and friction, Schauberger's designs pulled inward, toward a vortex center, generating suction rather than pressure.

This period of his life grew considerably darker. In 1940 he contracted with a firm in Berlin to build his machine, then in February 1941 switched to a company in Vienna; that same month he began working, under circumstances that remain disputed in their particulars, for the Nazi government. By 1944, the research program built around his designs—refining what became known as the Repulsine, an implosion-driven turbine—made use of forced labor from the Mauthausen concentration camp. The documentary record on the precise nature of Schauberger's involvement and the degree of coercion is genuinely contested among historians; what is established is that he did not seek out this arrangement and that, at the war's end, American forces apprehended him and debriefed him over a period of roughly nine months.

After the war, Schauberger returned to Austria and continued his work on water-based power generation, vortex turbines, and a “spiral plough” intended to improve soil cultivation through copper implements shaped to mimic natural spiraling growth patterns. He published, wrote extensively, and continued refining his theory that nature's structuring principle—the vortex—represented an alternative and largely unexplored path for generating usable energy.

In 1957, Schauberger and his son Walter were invited to the United States by businessmen Karl Gerchsheimer and Robert Donner, who sought to put his implosion technology into commercial production. The visit did not go as planned. A bitter dispute arose over the terms of the arrangement, and Schauberger was reportedly compelled to sign an agreement restricting his further research into implosion technology, leaving behind documents, models, and equipment in the United States. He returned to Linz, Austria. Five days later, on 25 September 1958, Viktor Schauberger died, at age seventy-three.

What Schauberger had demonstrated, through decades of patient observation and practical invention, was that the same rotating, vortical geometry that Ampère had measured in current-carrying wires, that Faraday had harnessed into continuous induction, that Maxwell had built into a mechanical model of the electromagnetic field—this same spiraling structure appeared, independently observed, in the motion of water. He had not derived this from electromagnetic theory. He arrived at it from watching rivers, streams, and the creatures that lived in them.

The flume worked. Logs denser than water moved on a thin layer of it, spinning through curves Schauburger had designed by watching a snake. The vortex, in his hands, was not abstraction. It was visible, physical, and useful—in water, just as it had been in wire.

Notes

1. Wikipedia, “Viktor Schauburger”; born 30 June 1885 in Holzschlag, Upper Austria.
- 2–3. Ibid.; forestry school in Aggsbach, forest clerk in Lower Austria, 1904–1906.
4. New Acropolis Library, “Viktor Schauburger and the Living Energies of Water.”
5. Ibid.; BRMI, “History – Viktor Schauburger.”
6. Natural Action Water, “Viktor Schauburger”; head warden, Brunnenthal-Steyerling, 1920.
7. BRMI, op. cit.
- 8–10. Natural Action Water, op. cit.; New Acropolis Library, op. cit.
- 11–12. Wikipedia, op. cit.; national consultant 1924–1928, first patents 1929.
- 13–14. Grokipedia, “Viktor Schauburger”; Natural Action Water, op. cit.
- 15–16. Wikipedia, op. cit.; Frank Germano, “Viktor Schauburger’s Repulsine.”
- 17–19. Wikipedia, “Viktor Schauburger”; documentary record on Mauthausen period contested among historians.
20. Wikipedia (archived version), “Viktor Schauburger.”
- 21–22. Wikipedia, op. cit.; Google Groups archive, “Viktor Schauburger’s Repulsin Technology.”
23. Wikipedia, op. cit.; died 25 September 1958.

Bibliography

- BRMI. “History – Viktor Schauburger.”
- Cook, Nick. *The Hunt for Zero Point: Inside the Classified World of Antigravity Technology*. New York: Broadway Books, 2001.
- Grokipedia. “Viktor Schauburger.”
- Natural Action Water. “Viktor Schauburger.”
- New Acropolis Library. “Viktor Schauburger and the Living Energies of Water.”
- Schauburger, Viktor. *Unsere sinnlose Arbeit*. Krystall-Verlag, 1933.
- Schauburger, Viktor, and Callum Coats. *Eco-Technology 1: The Water Wizard*. Gateway Books, 1998.
- “Viktor Schauburger.” Wikipedia.

Eric Laithwaite and the Vortex Made Practical in Motion

Eric Roberts Laithwaite was born on 14 June 1921 in Atherton, Lancashire, England, the son of a farmer. He was educated at Kirkham Grammar School and later at Regent Street Polytechnic. In 1941, he joined the Royal Air Force, serving through the Second World War and rising to the rank of Flying Officer, working as a test engineer on autopilot technology at the Royal Aircraft Establishment in Farnborough.

On demobilization in 1946, Laithwaite enrolled at the University of Manchester to study electrical engineering. His early work involved the Manchester Mark I, one of the first stored-program computers in the world—earning him his master's degree. It was his subsequent doctoral research, though, that set the course of his career: he became fascinated with linear induction motors.

The principle was elegant in conception. A conventional electric motor—the kind Tesla had perfected through his rotating polyphase fields decades earlier—produces rotational motion: a rotor spins inside a stator. Laithwaite's insight was to imagine that same motor unrolled flat. Instead of a rotor spinning inside a circular stator, imagine the stator laid out in a straight line, with the moving part gliding along it, propelled directly by the traveling magnetic field rather than by rotating components, wheels, or gears. The rotating vortex field that Faraday and Maxwell had described, that Tesla had harnessed for rotational motion, could be stretched into a line and used to push an object directly forward—pure electromagnetic thrust, without mechanical intermediaries.

Laithwaite derived a mathematical formula he called the “goodness factor,” a parameter describing the efficiency of a motor design, and demonstrated that—counterintuitively to much of the engineering establishment at the time—larger linear motors tended to become more efficient, not less. Through the 1950s, working at Manchester, he built and tested small-scale prototypes, establishing proof of concept. In 1964, he was appointed Professor of Heavy Electrical Engineering at Imperial College London, where he built a dedicated laboratory and expanded his research into electromagnetic propulsion.

His most visible achievement came in 1974 and 1975: the Magnetic River, developed with Fredrick Eastham, an electrodynamic levitation system that used a

linear induction motor's transverse magnetic flux to lift a thin conductive plate and propel it along a track simultaneously—both levitation and propulsion from the same field geometry. The demonstration was striking enough that it later appeared in the 1977 James Bond film *The Spy Who Loved Me*, where the device levitated and propelled a tray along a table. Laithwaite's linear motor work also found application in the Tracked Hovercraft project, intended as a high-speed transit system, though the project was cancelled by the British government in 1973 amid disputes over its cost relative to conventional rail.

Laithwaite's career, by the mid-1970s, stood at its height—a respected professor, a public communicator of science known for his BBC television appearances, and an engineer whose practical demonstrations had moved electromagnetic theory from blackboard to working hardware.

Then, in 1974, the Royal Institution invited him to give a public lecture on a subject of his own choosing. He chose gyroscopes—a topic he had only recently become interested in, after an amateur inventor named Alex Jones approached him with a small prototype: a wagon propelled, apparently, by nothing more than the swinging of an internal pendulum. Laithwaite watched the demonstration and, by his own account, became convinced he had witnessed something that conventional physics said should be impossible.

In his lecture and subsequent demonstrations, Laithwaite showed spinning gyroscopes exhibiting behavior that seemed, to him and to much of his audience, to defy conventional mechanics—lifting unexpectedly, behaving as though their effective weight had changed under rotation. He used engineering approximations in his calculations to describe these effects. When professional mathematicians and physicists subsequently performed the calculations rigorously and found no discrepancy with standard Newtonian mechanics, Laithwaite did not accept their correction.

The consequences for his career were severe and lasting. His nomination for Fellowship of the Royal Society was cancelled. He left his position at the Royal Institution. He was, by one historian's account, never granted an entry in the *Oxford Dictionary of National Biography* despite the significance of his linear motor work—an omission that has since been described as unfair, irrespective of the controversy surrounding his later views. He retired from Imperial College, by most accounts in 1986, though some sources describe the circumstances of his departure as effectively forced and the years surrounding it as professionally damaging. He

was offered no further research position until 1990, when he became a visiting professor at the University of Sussex.

Laithwaite never recanted. Decades later, reflecting on the controversy, he was quoted saying that none of his critics had ever been able to explain to him how a fifty-pound spinning wheel could appear to lose weight. He continued exploring gyroscopic behavior for the rest of his life, founding a company, Gyron Ltd., with collaborator William Dawson, and in 1993 applying for a patent—granted in 1999, after his death—for a propulsion system based on his gyroscopic principles.

In his later years, despite the institutional rejection, Laithwaite continued working. At seventy-six, he was engaged by NASA to develop a concept for an electromagnetic launch system—a track that would use linear motors, the same technology underlying the Magnetic River, to accelerate a payload through a mountain tunnel and into orbit without conventional rocket propulsion. He died on 27 November 1997, in Falmer, East Sussex, at age seventy-six, while still actively working.

What Laithwaite had demonstrated, unambiguously and to lasting practical effect, was that the rotating field—Faraday's induction, Maxwell's vortex, Tesla's polyphase motor—could be unrolled, stretched flat, and used to move objects directly through space without wheels, gears, or rotating shafts. This was not contested. It built trains, lifted trays, and nearly launched a NASA spacecraft. What was contested—bitterly, and at the cost of his standing in the institutions he had served for decades—was his further claim that spinning mass under certain conditions could exhibit effects beyond what conventional mechanics predicted.

The motor worked. The field moved things in a straight line exactly as he said it would. On the gyroscope, the establishment said no—and unlike Bruno, unlike Tesla, Laithwaite lived another twenty-three years insisting that they were the ones who hadn't looked closely enough.

Notes

1. Wikipedia, “Eric Laithwaite”; born 14 June 1921, Atherton, Lancashire.
- 2–3. Ibid.; RAF service 1941–1946; University of Manchester, 1946.
4. Ibid.; Manchester Mark I computer work; doctoral research into linear induction motors.
5. Northeast Maglev, “Meet Dr. Eric Laithwaite, the 'Father' of Maglev.”

- 6–8. Wikipedia, op. cit.; Grokipedia, “Eric Laithwaite”; appointed Professor at Imperial College, 1964.
- 9–11. Wikipedia, “Magnetic River”; appearance in *The Spy Who Loved Me* (1977); Tracked Hovercraft cancelled 1973.
- 12–13. Liquisearch, “Eric Laithwaite – Biography”; Alex Jones demonstration, 1974.
- 14–15. Royal Institution, “The gyroscope, an engineer and the Christmas Lectures.”
- 16–17. The Times, “Professor Eric Laithwaite” (obituary); Royal Institution, op. cit.
- 18–19. The Times, op. cit.; Wikipedia, op. cit., noting 1986 retirement date; visiting professor at Sussex, 1990.
20. The Times, op. cit.
21. Academic Kids, “Eric Laithwaite”; Gyron Ltd., patent granted 1999.
- 22–23. The Times, op. cit.; Wikipedia, op. cit.; died 27 November 1997.

Bibliography

Academic Kids. “Eric Laithwaite.”

Grokipedia. “Eric Laithwaite.”

Liquisearch. “Eric Laithwaite – Biography.”

Northeast Maglev. “Meet Dr. Eric Laithwaite, The ‘Father’ of Maglev.”

Royal Institution. “The gyroscope, an engineer and the Christmas Lectures.”

The Times. “Professor Eric Laithwaite” (obituary).

“Eric Laithwaite.” Wikipedia.

“Magnetic River.” Wikipedia.

Eric Lerner and the Plasma Universe

Eric J. Lerner was born on 31 May 1947 in Brookline, Massachusetts. He attended Columbia University, where, during the late 1960s, he was active in civil rights and student activism—taking part in the 1965 Selma March and the 1968 Columbia student strike, experiences that shaped a lifelong willingness to challenge institutional consensus. His scientific path led him toward plasma physics, the study of the ionized, electrically conductive state of matter that makes up the overwhelming majority of the visible universe—stars, nebulae, the solar wind, the space between galaxies.

Beginning in 1984, Lerner developed a quantitative theory of a device called the dense plasma focus, building on the earlier work of Swedish physicist Hannes

Alfvén, a Nobel laureate whose research had established plasma physics—rather than gravity alone—as a major force shaping cosmic structure. Lerner used the plasma focus device's behavior as a laboratory model for understanding quasars and other energetic astrophysical phenomena, proposing that the same electromagnetic filamentary structures that organized plasma in his small laboratory device also organized matter at the scale of galaxies.

This research led Lerner, in 1991, to publish *The Big Bang Never Happened: A Startling Refutation of the Dominant Theory of the Origin of the Universe*. The book argued for plasma cosmology—the idea, advanced originally by Alfvén, that electromagnetic forces acting on ionized plasma, not gravity working on a universe expanding from a single point of origin, were the primary architects of large-scale cosmic structure. Lerner contended that the universe was eternal and infinite in both time and space, with neither beginning nor creator required, and that the Big Bang model, despite its dominance, faced unresolved problems: the unexpectedly clumped, filamentary large-scale structure of the universe in a model that originally predicted homogeneity; the unaccounted-for “missing mass” later termed dark matter; and an estimated age of the universe that, at the time, conflicted with the ages of its oldest observed stars. The book received attention well beyond the usual readership for technical cosmology—a Kirkus review noted that Lerner brought ambitious confidence to taking on establishment science directly, while linking the rise of Big Bang cosmology to broader currents in the history and sociology of scientific thought.

Lerner's plasma cosmology drew serious and immediate criticism from mainstream cosmologists, several of whom publicly distanced themselves from data Lerner had cited in support of his arguments. The Big Bang model, by contrast, continued to account successfully for a wide range of independent observations—the cosmic microwave background radiation, the relative abundance of light elements, the redshift-distance relationship—in ways that critics argued plasma cosmology could not match. The scientific consensus did not shift. Lerner's cosmological model remained, and remains, outside the mainstream of astrophysics.

What Lerner did not abandon was the plasma focus device itself—and over the following decades, that device became the center of an entirely separate, and more experimentally grounded, pursuit: nuclear fusion.

Between 1994 and 2001, NASA's Jet Propulsion Laboratory funded Lerner's small company, Lawrenceville Plasma Physics—at the time, Lerner's sole

employee—to investigate whether his dense plasma focus approach might be useful for spacecraft propulsion. In August 2001, working at Texas A&M University under this funding, Lerner's team achieved plasma temperatures above one billion degrees in the device—high enough, in principle, for hydrogen-boron fusion reactions, a fusion fuel cycle that, unlike the deuterium-tritium reactions pursued by most government-funded fusion programs, produces no neutron radiation and no radioactive waste.

In 2003, Lerner formally incorporated LPPFusion to pursue this approach commercially, building what became known as the Focus Fusion device—a machine notably smaller and less expensive than the large tokamak reactors that have received the overwhelming majority of global government fusion funding. A 2007 New York Times article observed that, despite this progress, Lerner had not received funding from the U.S. Department of Energy, the primary government funder of fusion research in America. The company instead raised funds from private investors—eventually more than \$8.6 million from over 800 individual backers—to continue its experiments.

In 2012, LPPFusion published results reporting plasma temperatures of 1.8 billion degrees, exceeding the previous record of 1.1 billion degrees that had stood since 1978. A subsequent review by a committee of senior fusion researchers, chaired by a former head of the U.S. national fusion program, concluded that Lerner's approach merited “a much higher level of investment” based on the progress demonstrated to date. Lerner's published research on fusion has appeared in peer-reviewed journals including *Physics of Plasmas*; his cosmological research has appeared in the *Astrophysical Journal* and *Monthly Notices of the Royal Astronomical Society*.

Lerner's cosmological views resurfaced prominently in public discourse in 2022 and 2023, when, following the first observations from the James Webb Space Telescope, he published an article arguing that the telescope's images—showing galaxies that appeared more massive and structurally mature at greater distances, and therefore earlier cosmic times, than standard Big Bang models predicted—supported plasma cosmology over the standard model. The article drew swift and largely critical response from astrophysicists, including some whose own data Lerner had cited, who argued that early JWST observations, while genuinely surprising and still being analyzed, did not constitute the kind of refutation Lerner claimed and remained consistent with refinements to the standard cosmological model rather than

its replacement.

What Lerner represents, across both halves of his career, is a particular version of the same pattern this chapter has traced: an independent thinker pursuing a model of the universe and a model of energy generation, both built on the electromagnetic and plasma-dynamic behavior of matter, in direct tension with mainstream consensus. His fusion research, grounded in repeatable laboratory results and reviewed by credentialed experts, has earned cautious, qualified respect even from skeptics of his cosmology. His cosmological claims remain a minority position, sharply contested, kept alive primarily through his own persistence and a small community of plasma cosmology advocates rather than broad acceptance within astrophysics.

The dense plasma focus does what Lerner says it does: it generates extraordinary plasma temperatures and densities in a small, inexpensive device, using electromagnetic pinch forces to compress ionized matter far beyond what its size would suggest possible. Whether that same electromagnetic plasma behavior explains the structure of the universe at the largest scales remains, decades after Lerner first proposed it, an open and unresolved argument.

Notes

1. Wikipedia, “Eric Lerner”; born 31 May 1947, Brookline, Massachusetts.
2. IAI TV, “Eric J. Lerner”; civil rights and activist history.
- 3–4. Plasma-Universe.com, “Eric Lerner”; LPPFusion, “Eric Lerner” biography page; “Theory of the Dense Plasma Focus as Fusion Device.”
5. Lerner, Eric J. *The Big Bang Never Happened*. New York: Vintage Books, 1991.
- 6–7. Kirkus Reviews, “The Big Bang Never Happened.”
- 8–9. *The Wire Science*, “Explained: The Deal With Eric Lerner Saying the Big Bang Didn't Happen.”
10. Wikipedia, *op. cit.*; NASA/JPL funding, 1994–2001.
- 11–12. LPPFusion, “Focus Fusion Timelines and Milestones.”
- 13–14. Wikipedia, *op. cit.*, citing 2007 New York Times article; LPPFusion, “Meet the Team Behind Focus Fusion Energy.”
- 15–17. Wikipedia, *op. cit.*; LPPFusion, “Former US Fusion Chief: Focus Fusion Merits Higher Investment”; LPPFusion biography page.
- 18–19. *The Wire Science*, *op. cit.*; 2022–2023 JWST controversy.

Bibliography

IAI TV. "Eric J. Lerner."

Kirkus Reviews. "The Big Bang Never Happened."

Lerner, Eric J. *The Big Bang Never Happened: A Startling Refutation of the Dominant Theory of the Origin of the Universe*. New York: Vintage Books, 1991.

LPPFusion. "Eric Lerner." Team biography page.

———. "Focus Fusion Timelines and Milestones."

———. "Former US Fusion Chief: Focus Fusion Merits Higher Investment."

———. "Meet the Team Behind Focus Fusion Energy."

Plasma-Universe.com. "Eric Lerner."

The Wire Science. "Explained: The Deal With Eric Lerner Saying the Big Bang Didn't Happen."

"Eric Lerner." Wikipedia.

Closing

Five hundred years of failing to answer "what is gravity" isn't evidence the question is just hard. It's evidence we've been asking the wrong question entirely. The same is true across physics: dark matter, dark energy, the origin of existence itself — all placeholders for mechanisms we don't understand, layered onto a foundational model that has never been mechanically coherent.

What if that model is simply wrong?

Not wrong in the sense of "close but needs refinement." Wrong in the sense of: built on institutional inertia, preserved through centuries because to question it would destabilize the apparatus of control itself. A system that demands proof from citizens while accepting, without mechanism or evidence, that everything exploded billions of years ago and has been decaying ever since.

Yet here's what's remarkable: physicists from Ampère onward kept observing the same thing. Vortex. Resonance. Geometric structure. Field. Each one moved closer to a mechanically coherent understanding — and each time, the mechanism was stripped away. Heaviside's own words: "I never made any progress until I threw all the potentials overboard." He discarded the vortex model that made the theory work, kept only the equations, and called it progress.

What if he was wrong?

What if, instead of entropy as the fundamental principle, reality operates in dynamic equilibrium — regenerative and degenerative forces in balance, not decay toward heat death? What if matter isn't a separate substance but geometric resonance patterns in a unified field? What if the same mechanism that generates atoms also generates galaxies, operating identically at every scale?

These aren't wild speculations. They're consistent frameworks that resolve what current physics cannot: they eliminate placeholders, describe causality, and explain observed phenomena without requiring invisible matter, invisible energy, or invisible forces.

An independent researcher, working outside institutional frameworks, has developed such a framework — a cohesive description of reality through geometric resonance and field equilibrium. Whether that framework is "correct" in some

ultimate sense is less important than this: it demonstrates that alternatives exist. Better alternatives. Ones that don't require us to accept foundational claims on faith.

The real question isn't whether this framework is proven. The real question is: why have we accepted a model with zero mechanism and demanded nothing better?

We are not living in a world of scarcity. We live in a sea of energy. The walls we perceive are only perceived. The possibilities are limitless.

If we can think clearly about how reality actually works, we can make clearer choices about how we organize ourselves within it. If we can recover the knowledge that was suppressed or discarded, if we can ask the questions institutions have forbidden, everything changes.

The future isn't predetermined. It's waiting to be imagined by people willing to think for themselves.

The future's so bright you might need sunglasses.

Author's Note

Paul Gene Conlan is an independent researcher who has developed a cohesive framework describing reality through geometric resonance and field equilibrium rather than entropic expansion. This book is not a proof of that framework, but an invitation to question whether our current foundational assumptions actually explain what we observe, or whether different questions might yield clearer answers.

In a world where institutions demand proof from citizens yet accept foundational claims without mechanism or evidence, perhaps the real question isn't whether alternative frameworks are correct, but whether we're asking the right questions at all.